

What is claimed is:

1. A method for automatically directing data in a computer network based on traffic demands, the method comprising:

- 5           (a) determining traffic demands of a computer network; and
- (b) automatically directing data in the computer network based on the determined traffic demands.

10           2. The invention of Claim 1, wherein (a) comprises determining traffic demands of a computer network at least in part from traffic data from a plurality of network elements in the computer network.

15           3. The invention of Claim 1, wherein (a) comprises determining traffic demands of a computer network at least in part from traffic predictions.

             4. The invention of Claim 1, wherein (a) comprises determining traffic demands of a computer network at least in part from a request.

20           5. The invention of Claim 4, wherein the request is expressed in terms of one or more of the following: bandwidth, latency, jitter, loss rate, protection type, and burst size.

             6. The invention of Claim 4, wherein the request is expressed using RSVP.

25           7. The invention of Claim 4, wherein the request is expressed using RSVP-TE.

             8. The invention of Claim 4, wherein the request is expressed using a user-to network interface.

9. The invention of Claim 4, wherein the request expresses a service level agreement that allows a customer to reserve a private path.

10. The invention of Claim 9, wherein the request expresses a service level agreement that allows a customer to reserve a protection path in addition to the private path.

11. The invention of Claim 1, wherein (a) comprises determining traffic demands of a computer network at least in part from a policy system.

12. The invention of Claim 11, wherein the policy system comprises a policy expressed in terms of one or more of the following: bandwidth, latency, jitter, loss rate, protection type, and burst size.

13. The invention of Claim 11, wherein the policy system is implemented using COPS.

14. The invention of Claim 11, wherein the policy system expresses a service level agreement that allows a customer to reserve a private path.

15. The invention of Claim 14, wherein the policy system expresses a service level agreement that allows a customer to reserve a protection path in addition to the private path.

16. The invention of Claim 1, wherein (a) comprises determining traffic demands of a computer network at least in part from at least two of the following: traffic data from a plurality of network elements, traffic predictions, a request, and a policy system.

17. The invention of Claim 1, wherein (a) and (b) are repeated periodically.

18. The invention of Claim 1, wherein (a) and (b) are repeated in response to an event.

19. The invention of Claim 18, wherein the event comprises receipt of a service level agreement.

20. The invention of Claim 18, wherein the event comprises a change in traffic demand.

21. The invention of Claim 1, wherein (b) comprises automatically directing data through a set of primary paths in the computer network.

22. The invention of Claim 21 further comprising providing a set of protection paths for the data.

23. The invention of Claim 22, wherein (b) comprises automatically directing data simultaneously over both the set of primary paths and the set of protection paths.

24. The invention of Claim 22, wherein (b) comprises automatically directing data over the set of protection paths only if a failure occurs on the set of primary paths.

25. The invention of Claim 22, wherein the set of primary paths comprises N primary paths and wherein the set of protection paths comprises M protection paths.

26. The invention of Claim 25, wherein (b) comprises automatically directing data over one of the M protection paths only if a failure occurs on one of the N primary paths.

27. The invention of Claim 1, wherein (b) comprises automatically directing data through at least one network element in the computer network.

28. The invention of Claim 27, wherein the at least one network element comprises a photonic switch.

29. The invention of Claim 28, wherein the photonic switch comprises a fiber-to-fiber switch.

30. The invention of Claim 28, wherein the photonic switch comprises a waveband-to-waveband switch.

31. The invention of Claim 28, wherein the photonic switch comprises a wavelength-to-wavelength switch.

32. The invention of Claim 27, wherein the at least one network element comprises an electronic switch.

33. The invention of Claim 32, wherein the electronic switch is operative to switch data from any wavelength on any incoming fiber to any wavelength on any outgoing fiber.

34. The invention of Claim 27, wherein the at least one network element comprises a label switched router.

35. The invention of Claim 34, wherein the label switched router implements multi-protocol label switching.

36. The invention of Claim 27, wherein the at least one network element comprises an optical packet switch.

37. The invention of Claim 27, wherein the at least one network element comprises an optical burst switch.

38. The invention of Claim 27, wherein the at least one network element comprises a SONET ADM.

39. The invention of Claim 1, wherein (b) comprises automatically directing data in the computer network by provisioning at least one of the following: a label switched path, a routing metric, a time slot, a fiber, and a wavelength.

40. The invention of Claim 39, wherein (b) comprises automatically directing data in the computer network by provisioning at least one of a label switched path, a routing metric, a time slot, a fiber, and a wavelength in a plurality of network elements, thereby forming a path through the computer network.

41. The invention of Claim 1, wherein (b) comprises automatically directing data in the computer network by setting at least one of a cost or a preference metric used by a routing protocol.

42. The invention of Claim 1, wherein (b) comprises load balancing the data across multiple paths in the computer network.

43. The invention of Claim 1, wherein (b) comprises minimizing an intervention of electrical devices when routing wavelengths either individually or in groups.

44. The invention of Claim 1, wherein (b) comprises configuring a path in the computer network.

45. The invention of Claim 1, wherein (b) comprises reconfiguring a path in the computer network.

46. The invention of Claim 1, wherein (b) comprises automatically directing data between at least two nodes of the computer network

47. The invention of Claim 1, wherein the computer network comprises at least one of a service provider's core network and a service provider's access network.

48. The invention of Claim 1, wherein the traffic demands are expressed in terms of one or more of the following: bandwidth, latency, jitter, loss rate, protection type, and burst size.

49. A system for automatically directing data in a computer network based on traffic demands, the system comprising:

a plurality of network elements in a computer network; and

a processor operative to determine traffic demands of the computer network and operative to automatically direct data in the computer network based on the determined traffic demands.

50. The invention of Claim 49, wherein the processor is operative to determine traffic demands of the computer network at least in part from traffic data collected from the plurality of network elements.

51. The invention of Claim 49, wherein the processor is operative to determine traffic demands of the computer network at least in part from traffic predictions.

52. The invention of Claim 49, wherein the processor is operative to determine traffic demands of the computer network at least in part from a request.

53. The invention of Claim 49, wherein the processor is operative to determine traffic demands of the computer network at least in part from a policy system.

54. A system for automatically directing data in a computer network based on traffic demands, the system comprising:

a plurality of network elements in a computer network;

a storage device;

a first processor coupled with the plurality of network elements and the storage device, the first processor operative to collect traffic data from the plurality of network elements and operative to send the collected traffic data to the storage device; and

a second processor operative to determine traffic demands of the computer network based on the collected traffic data and operative to automatically direct data in the computer network based on the determined traffic demands.

55. The invention of Claim 54, wherein the second processor is operative to determine traffic demands of the computer network at least in part from traffic data collected from the plurality of network elements.

56. The invention of Claim 54, wherein the second processor is operative to determine traffic demands of the computer network at least in part from traffic predictions.

57. The invention of Claim 54, wherein the second processor automatically directs data in the computer network by sending a plurality of network transformation instructions to a third processor, and wherein the third processor determines which of the plurality of network transformation instructions to send to each of the network elements.

5

58. The invention of Claim 57, wherein the third processor is further operative to arrange the plurality of network transformation instructions in an order that will not result in an invalid network state when implemented.

10

59. The invention of Claim 57, wherein the third processor is further operative to convert a selected network transformation instruction into a form appropriate for a selected network element.

15

60. The invention of Claim 57, wherein the third processor is operative to send a selected network transformation instruction to the first processor for transmission to a selected network element, and wherein the first processor is further operative to convert the selected network transformation instruction into a form appropriate for the selected network element.

20

61. A system for automatically directing data in a computer network based on traffic demands, the system comprising:

means for determining traffic demands of a computer network; and

means for automatically directing data in the computer network based on the determined traffic demands.

25

30